THE PERILS OF MINING.

BY WM. SMURTHWAITE.

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How few, as they sit enjoying themselves by a comfortable fire, listening to the bleak winds of winter howling and raging past their dwellings, think of hardships and dangers of the coal miner descending into the bowels of the earth, shut out from the sunlight of heaven from eight to ten hours per day, struggling on in a cramped condition amid the surrounding darkness, having but a flickering light of a common oil lamp to enable him to dig the black

treasures which are to carry light, warmth and comfort to the busy world above.

Few of them live to the allotted years of human life. They breathe into their system air contaminated with powder, smoke and decomposed matter, shortening life. They are exposed to the dampness of the mine, they engender disease and frequently become crippled with rheumatism when they have lived but little over one-half of a natural life.

Their whole life is full of peril and danger. The moment they step upon the platform of the cage to descend into the mine their lives are in jeopardy. The rope to which the cage is suspended may break, or a bolt may snap, or some other part of the machinery may be defective, which would precipitate the cage with its living freight to the depths below to be dashed to pieces.

I believe there exists in the minds of the miners more real enjoyment in anticipation of reaching their homes again after their day's work is done than there does in the minds of any other class of men. Having been shut out from the busy scene of life above for several hours, away from home and friends, they long to reach the sacred spot again to spend the rest of the day with them, and, with such expectant hopes, they hurry along the silent galleries to reach the bottom of the shaft to be hoisted again to the surface. But how often are their fond desires frustrated by some unfortunate circumstance when almost within the sight of home. They step upon the platform full of joyous hope that they will soon see the light of day. The signal is given, to indicate to the engineer above that all is ready below, and the cage moves upward with its precious burden, their lives depending upon the watchfulness of the engineer and should he for a moment neglect his duty the next instant the cage crushes against the sheaves and they are thrown out and killed at the bottom.

While these dangers are great they are by no means the greatest. Everywhere there is suspended over their heads great masses of loose material ready to fall and bury them beneath its weight while at work. The greatest caution must be exercised, in order to avoid being crushed, by sufficiently propping up the loose material, and yet, notwithstanding all the skill and care taken, a great many lives are lost annually by falls of slate. There are roofs which are treacherous, as if a portion of it had been deposited at a later period and has no binding connection whatever with the surrounding material. It has a fine polished surface or sides, generally called slips, running up, sometimes, several feet, resting on the coal head, with nothing to indicate that there is danger, all lines having been obliterated by pieces of coal sticking to the roof; and it frequently happens that it falls without giving the least warning, after the coal is removed, crushing its victim to death.

There is also great danger arising from inundations, by holing into old mines that have been long abandoned and allowed to fill up with water. There are mines, no doubt, even in our own state, that have been abandoned for many years, out of which many acres of coal have been taken, and large

areas passed over of which but few know anything. To provide against such dangers plans ought to be made, showing the position they occupy to adjacent works whose coal-fields lie contiguous, so that all the necessary care may be taken as they approach them, by drilling holes reaching several feet ahead, in the leading places, before the coal is removed. It might be that a correct plan could not be made without having access into the mine, and that would be impossible, if filled up with water; but the best information ought to be sought from any who may have worked or operated them in the past, before it be too late, and valuable information lost. A survey could be made, based upon knowledge so acquired, by going over the surface and locating, as near as possible, the extent of the works. This would be a guide to some extent, although an imperfect one, and might be the means of saving both life and property. In the past many lives have been lost by not having a plan, showing the danger point, which might have been saved. It is only a few years ago that a dreadful inundation occurred in one of the large collieries in Wales where several lives were lost and many suffered the most excruciating tortures for want of light and food, having fled before the surging flood to a high point just beyond the reach of the water. It was found upon examination, that an entry must be driven several yards by the rescuing party, and at a great risk of their own lives, before their comrades could be extricated from their perilous condition.

But has it not entered into the history of mining in this country, where it has been chronicled that the lives of many miners have been lost by flooded mines that might have been saved by the exercise of proper prudence and care? Therefore, the experience of the past ought to be a sufficient incentive to all, to use every means to have such rules and regulations adopted as will secure to our fellow-men immunities from such dangers.

But these are not all of the dangers they are exposed to. They move at times in an atmosphere into which a million pores distill a deadly vapor. The very air they breathe is a magazine of destruction, and all that separates between them and death is a lamp, generally known as a safety lamp, in the hands of each workman, but should any one of them, by carelessness or otherwise, injure their lamps the lives of all are in jeopardy.

The light of the safety lamp is surrounded by a wire gauze having 724 apertures to the square inch. The gas enters through these apertures and is consumed there; and if the air in the mine contains a high per centage of explosive gas the wire will only become red-hot and will not permit the flame to pass outward and ignite the gas as long as the lamp is not injured by too much exposure. It has been proven, however, by actual tests, that a current of air, at a velocity of from five to eight feet per second, will drive the flame out beyond the wire gauze and ignite the gas, which has led to the invention of many new safety lamps. The best and safest lamps now in use are those which become extinguished in an explosive mixture, as sudden outbursts of gas have occurred which no foresight could anticipate

or prevent. The only safety for the miner under such sudden effusions of gas is in the excellence of his lamp. Sometimes an outburst will take place from the floor of the mine in such quantities that no possible amount of ventilation could clear away until it had partially spent itself. I have frequently seen a great outgush of gas from the roof of the mine, without having given the slightest indication or warning and when but very little gas exuded from the face of the coal, and to such an extent, as to contaminate the air for days, while at the same time a vigorous current of air was circulating in the mine.

It is stated, by authority, that the loss of life by explosions in Great Britain during the year 1884, was no greater for hoisting 170,000,000 tons than it was for 40,000,000 tons previously. This is certainly a good report and speaks well for the great improvement in coal mining, of which I think great credit is due to the improved safety lamp. Yet fire-damp still continues and will continue to be the greatest danger the miner encounters. It has slain its thousands, while carbonic acid gas and other gases, which infest the coal mine, have played a great part in adding to the death roll.

There are mines which give off fire-damp in greater quantities than others do even in the same district. For instance, in the Steubenville district some of the mines give off this gas, at times, very profusely while in others it is seldom seen.

Fire-damp accompanies certain coals and whenever the per centage of volatile matter is large this gas will be discharged; notwithstanding the preconceived notion, held by some, that gas is always absent above water level. It may not, at all times, be given off in such quantities that its presence may be detected, especially if the current of air be very vigorous, and because of this many have been led to believe that it was entirely absent.

Harboring such thoughts naturally leads to a careless indifference on the part of those whose duty it is to examine the mine; also to neglect the keeping up of a vigorous current of air which often leads to serious accidents. In nearly every explosion that has occurred statement upon statement has been made, even upon oath, that gas was never seen in that part of the mine prior to the time of the explosion; and we have no reason to doubt this statement.

Every practical miner who has charge of a mine where this gas gives off, knows that it may be discovered at one time and not at another, and only awaits a suitable opportunity to escape from its prison cells in all of its force when the pressure is released by a sudden change of the atmosphere. It may be said, and with truth, that fire-damp is a natural enemy to the miner, and without it is shorn of its power, by using force against force to keep it confined in the pores of the coal and strata from whence it escapes, it will be a destructive agent to human life.

The only way then, for the health and safety of the miner is to constantly keep up a vigorous current of air, and conduct it in such a manner that it will sweep every corner and recess of the mine, diluting and carrying off all the

noxious gases as fast as they issue from the pores of the coal. If the current be insufficient or accidentally interrupted, the foul vapors accumulate and a naked light explodes the whole mine, burning, suffocating or dashing to pieces every living being in its range.

A mine may have a strong current of air circulating and well distributed over the various sections and yet may not be well ventilated, the air circulating may be just commensurate with the work it has to perform, having no surplus to meet emergencies which may arise at any time. A mine well ventilated is not only to have sufficient air for human consumption and to just meet the ordinary dangers arising from the constant oozing out of gases, but to have a sufficiency to meet any extra accumulation that may occur from falls or other causes, so that the quantity may be properly mixed to render it harmless. Careful study has shown that in almost every instance explosions have occurred with a falling barometer and with certain changes of the temperature.

The pressure of a heavy column of air tends to force back the gases into the fissures and pores, and when the pressure is lightened they issue in greater force and the increased danger must be met by increased ventilation; therefore, a mine which is ventilated above its ordinary needs will not be found wanting in such cases.

It is certainly gratifying to all who are interested in coal mining, and especially to those who have daily to meet the dangers, to know that great improvements have been made within the last few years in the means employed to prevent explosions, which had become very alarming in consequence of the fearful loss of human life.

Men of science came to the rescue of the miner in studying out the problems of ventilation and inventing a more perfect safety lamp. All of their studies have been chiefly based upon the law of the diffusion of the gases in coal mines and better methods of ventilation to carry them away and by their researches they have given to the mining world valuable information which has been a great boon to the miners in reducing explosions down to a minimum.

As to the danger of the explosiveness of coal dust, which is the all-absorbing topic with those who are deeply interested in mining, and also of mining experts who are now engaged in investigating the question as to its dangerous qualities, I have no fear of it, only so far as it is an assistant in giving force to a fire-damp explosion. But should it be demonstrated by actual tests, with the air moving at the ordinary speed at which it moves when the mine is at work and at even the highest temperature that is registered in any mine, that it will explode, I will conclude that the coal dust theory is correct.

But my experience is entirely different to the above and I have worked in mines that had all the requisites to invite an explosion of this kind, being very fiery, as the terms are expressed, giving off large quantities of gas, and with the dust extremely dry and fine; yet I never saw the least sign of an explosion by a blow-out shot, but have seen the flame prolonged quite a distance, probably thirty

or forty feet; but I attributed it to the air having a small percentage of fire-damp mixed with it and not exclusively to the coal dust. I have never seen, in ordinary work, coal dust ignited without the presence of fire-damp.

If the air is laden with fine particles of dust, as it passes along the entries ventilating the working faces and is in danger of ignition by a blow-out shot or a blazing lamp increasing the temperature, would it not be equally charged upon its return and explode on the furnace?

Miniature explosions have frequently occurred as the return air would pass over the furnace, but it was always known that at such times the return air was impregnated with fire-damp.

If coal dust is such a dangerous explosive, what astonishes those practical men who have given it some consideration, is to know how it is that so many mines have escaped from being blown up when the coals in many of them have all of the essentials which would lead to such a calamity. With but few exceptions there never has been an explosion that could not be traced to fire-damp. The condition upon which those tests have been made are similar to the operations which are passing on in the mines. For instance, there may be say five thousand feet of air in a section of the mine traveling along an entry at a velocity of eighty feet per minute to ventilate, say thirty rooms, the rooms having been driven up from the entry eighty feet. The air would necessarily move slowly up into the room, the area being so great, creeping along the floor until it reached the face, then rising upwards to the roof, return again to the entry.

I reason from the above that the room would be the place for an explosion to occur and not the entry. In the absence of fire-damp in the room should the dust be ignited by a blow-out shot it would only inflame and not explode.